DOCUMENT RESUME

ED 326 201 IR 014 742

AUTHOR Clariana, Roy B.
TITLE Modifying Multiple-Choice Questions in Computer-Based Instruction.
PUB DATE 16 Oct 90
NOTE 10p.
PUB TYPE Viewpoints (120) -- Reports - Research/Technical (143) --

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Comprehension; *Computer Assisted Testing; Difficulty Level; *Measurement Techniques; *Multiple Choice Tests; Secondary Education; *Test Construction; *Test Items
IDENTIFIERS Paraphrase

ABSTRACT

Research has shown that multiple-choice questions formed by transforming or paraphrasing a reading passage provide a measure of student comprehension. It is argued that similar transformation and paraphrasing of lesson questions is an appropriate way to form parallel multiple-choice items to be used as a posttest measure of student comprehension. Four parallel items may be derived from a lesson: (1) an item that is neither transformed nor paraphrased, thus testing simple rote memory; (2) an item that is transformed only; (3) an item that is paraphrased only; and (4) a compound item that is both transformed and paraphrased. These four items produce a hierarchy of difficulty from easy (rote) to difficult (compound), depending on the extent to which an item is altered from the original lesson question. In the three studies cited in this paper, posttest performance for the four types of items followed the hypothesized hierarchy of difficulty, and this is viewed as evidence that many of the cognitive skills underlying comprehension may also be hierarchically related. It is concluded that the formation of test questions from lesson items provides a practical way for designers to utilize multiple-choice items for instruction and also for posttest assessment. (DB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED326201

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Modifying Multiple-Choice Questions in Computer-Based Instruction

by Roy B. Clariana

October 16, 1990

Submitted to:
Syracuse University / School of Education
ERIC Clearinghouse on Information Resources
030 Huntington Hall
Syracuse, New York 13244-2340
(315) 443-3640

Editorial Contact:
Dr. Roy B. Clariana
Training/Evaluation Specialist
E G & G, Rocky Flats Plant
Building 060
P.O. Box 464
Golden, CO 80402-0464
(303) 744-8012

Running Head: Modifying multiple-choice questions

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Roy B. Clariana

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Modifying Multiple-Choice Questions in Computer-Based Instruction

October 1990

Abstract

This paper describes two methods for adapting multiple-choice questions in order to form parallel items at different levels of comprehension. Following Bormuth (1970), Anderson (1972) described a way to form posttest questions (i.e. items) from reading passages. He argues that these items formed by transforming or paraphrasing a passage provide a measure of student comprehension of the passage. Applying this same method to lesson items appears to be an appropriate way to form parallel posttest items. In the three studies cited, posttest performance for the four types of items followed the hypothesized hierarchy of difficulty. These results are viewed as evidence that many of the cognitive skills underlying comprehension "may be hierarchically related" (Bormuth, Manning, Carr, & Pearson, 1970). This methodology appears to provide a differential measure of comprehension. If so, this method provides a practical way for designers to utilize multiple-choice items for instruction and also for posttest assessment.

Modifying Multiple-Choice Questions in Computer-Based Instruction

October 1990

Multiple-choice questions (i.e. items) are an unusually convenient and powerful instructional format in computer-based lessons that provide information to the learner through the stem, correct response option, and incorrect options. They allow for learner-lesson interaction through learner overt response and program-provided feedback. Importantly, the number of answer options is finite, and individualization via branching is possible based upon the learners' correct and incorrect responses. Additionally, multiple-choice tests can be delivered and marked by computer thus increasing the efficiency of the instructional process.

However, if multiple-choice items are used during instruction, it would be inappropriate to use the exact same items for post-lesson assessment. Such a test would only measure rote learning. In order to take advantage of the convenience of multiple-choice items, one often-used procedure is to utilize multiple-choice items during the lesson and then use parallel constructed-response items on the posttest. This method is straightforward and effective. One minor problem is that computer-marking of constructed-response type items (i.e. fill in the blank) is sometimes problematic. Learners may know the correct answer but may miss an item due to syntax, spelling, or other unexpected variables. Often constructed-response posttests must be remarked by hand.

The purpose of this study is to describe a method for adapting multiple-choice items so that parallel forms of the same item may be used during the lesson for

instruction and during the posttest for assessment. Data from three studies are shown to support this item modification method.

Transformational Analysis

The term transformational analysis (Bormuth, 1970) applies to the process of generating test items from instructional text (see Figure 1). Anderson (1972) described two methods for developing test items from reading passages in order to asses comprehension. These methods include paraphrasing and transforming. Paraphrasing involves changing the words from the reading passage by replacing words with equivalent words (i.e. semantic substitute), while maintaining the meaning of the reading passage. Transforming, in this instance, involves reversing the original order of the sentence subject and predicate elements. The noun phrase in the subject of the sentence becomes the correct answer option of the parallel posttest item; and the noun phrase in the predicate becomes the stem of the parallel posttest item (i.e. passive transform).

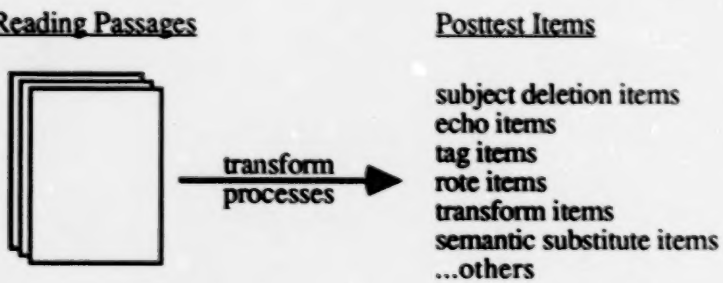

Figure 1. Modifying posttest items from reading passages (Bormuth, 1970).

These two methods are not mutually exclusive. An item might be not-transformed and not-paraphrased (i.e. verbatim, also termed rote), transformed and not-paraphrased (i.e. transformed), not-transformed and paraphrased (i.e. paraphrased), and compound (i.e. transformed and paraphrased). Thus four parallel multiple-choice items can be created by crossing these two procedures. A very simple example of a lesson sentence and four parallel items based on this sentence are shown in Table 1.

Table 1
Four parallel items derived from a sentence taken from a lesson.

Sentence from a lesson: Little Rock is the Capital City of Arkansas.
Verbatim: Little Rock is (a) the Capital City of Arkansas (b) the Capital City of Tennessee (c) the Capital City of Missouri.
Transformed: The Capital City of Arkansas is (a) Little Rock (b) Memphis (c) Arkadelphia.
Paraphrased: Little Rock is the official seat of government in (a) Arkansas (b) Tennessee (c) Missouri.
Transformed-Paraphrased: The official seat of government of Arkansas is in (a) Little Rock (b) Memphis (c) Arkadelphia.

Bormuth, Manning, Carr, and Pearson (1970) used posttest items that were verbatim from the reading passage, paraphrased from the reading passage, transformed from the reading passage, and both paraphrased and transformed from the reading passage. These four conditions are displayed in a two by two matrix (see Figure 2) with the following scores on the immediate posttest: verbatim, 77%; transformed, 71%; paraphrased, 69%; and transformed-paraphrased 67%. Verbatim

(i.e. not paraphrased and not transformed) items obtained the highest scores with the transformed and paraphrased items next. The combination of transform and paraphrase methods produced the most difficult items.

	Not Transformed	Transformed
Not Paraphrased	77%	71%
Paraphrased	69%	67%

Figure 2. Scores for the four types of items used by Bormuth et al. (1970).

Bormuth (1970) observed, "It is a commonly observed phenomenon in test writing that altering the form of an item has some effect on its difficulty" (p. 15). Applying these two methods appears to impact item difficulty and thus posttest performance for each type of item in a logical way (Davey, 1988). Anderson (1970) argues that these items provide a measure of comprehension of lesson materials.

This paper suggests that paraphrasing and transforming can be applied to lesson items as well as to reading passages (see Figure 3).

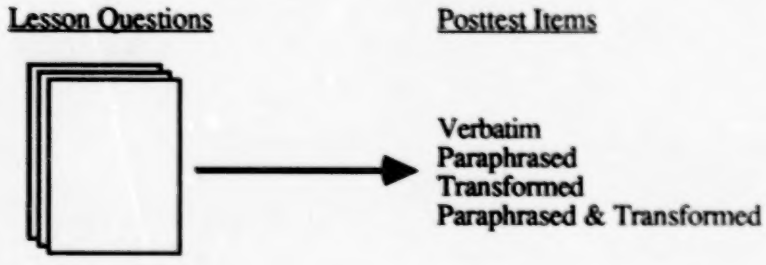

Figure 3. Modifying posttest items from lesson items.

This would allow for the development of posttest items that parallel lesson items and provide a measure of comprehension. If the transform and paraphrase methods described above are employed, again four types of parallel posttest items will result. What are the effects on posttest performance of these different item types? The results of three studies are described to support this methodology.

Study 1

A sample of 32 "at risk" eleventh-grade students completed a computer-based social studies lesson composed of 32 four-option multiple-choice items with feedback which included four associated 350-word reading passages. The posttest consisted of 32 parallel four-option multiple-choice items, half were verbatim to the lesson items and half were paraphrased from the lesson items. The results for these paraphrase posttest items were similar (i.e. compare Figure 4 to Figure 2) to those reported by Bormuth et al. (1970). Transformed questions were not used.

	Not Transformed	Transformed
Not Paraphrased	78.5%	n/a
Paraphrased	59.8%	n/a

Figure 4. Posttest Results for Study 1.

Study 2

A sample of 36 "average" tenth-grade students completed a workbook containing four natural-science reading passages and 40 related multiple-choice items

provided with different forms of feedback. The posttest included all four types of modified items, both transformed and paraphrased. The results for each question type are shown in Figure 5.

	Not Transformed	Transformed
Not Paraphrased	47.9%	39.2%
Paraphrased	40.8%	30.0%

Figure 5. Posttest Results for Study 2.

Study 3

A group of 103 "at risk" eleventh-grade students completed a computer-based science lesson consisting of 40 four-option multiple-choice items with feedback. Some also received 4 associated 350-word reading passages. The posttest consisted of 40 four-option multiple-choice items that were parallel to the lesson items. This study used the same lesson and posttest items as Study 2 above. These posttest items consisted of all four categories that can occur by using the transforming and paraphrasing methods. The results (see Figure 6) again were similar to those reported by Bormuth et al. (1970).

	Not Transformed	Transformed
Not Paraphrased	80.4%	47.7%
Paraphrased	46.3%	40.4%

Figure 6. Posttest Results for Study 3.

Discussion

Transforming and paraphrasing lesson text to form multiple-choice posttest items is not a new idea. Applying this same method to lesson items rather than lesson text allows designers to utilize multiple-choice items both for instruction during the lesson and for assessment during the posttest. The test items produced will obviously parallel the lesson items one-to-one in terms of content (i.e. instructional objectives) and appear to create a systematic range of item difficulties. These results are viewed as evidence that many of the cognitive skills underlying comprehension "may be hierarchically related" (Bormuth et al., 1970).

References

Anderson, R. C. (1972). How to construct achievement tests to assess comprehension. Review of Educational Research, 42(2), 145-170.

Bormuth, J. R. (1970). On the theory of achievement test items. The University of Chicago Press.

Bormuth, J. R., Manning, J., Carr, J., & Pearson, D. (1970). Children's comprehension of between- and within-sentence syntactic structure. Journal of Educational Psychology, 61, 349-357.

Davey, B. (1988). Factors affecting the difficulty of reading comprehension items for successful and unsuccessful readers. Journal of Experimental Education, 56, 67-76.

Note:

The data reported in *Study 1* was part of a previously reported study titled "Two immediate feedback forms with two conditions of contextualization" in the Journal of Computer-Based Instruction, in press. The data from *Studies 2 and 3* were part of a dissertation completed at Memphis State University titled "An experimental study comparing three forms of feedback across two conditions of acquisition".